Journal of Applied Life Sciences International
8(1): 1-8, 2016; Article no.JALSI.20022
ISSN: 2394-1103

SCIENCEDOMAIN *international*
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Somatotype of Undergraduate Medical Students of the University of Lagos

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Authors' contributions

This work was carried out in collaboration between all authors. Author NMI designed the study and supervised the work. Author AA collected the data, contributed during sample collection, analysis and acquisition of data as well as in the interpretation of results. Authors OE and KA contributed during analysis and interpretation of results and managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JALSI/2016/20022
Editor(s):
(1) Shahira M. Ezzat, Department of Pharmacognosy, Faculty of Pharmacy, Cairo University, Egypt.
Reviewers:
(1) Moushira Erfan Zaki, National Research Centre, Egypt.
(2) Mra Aye, Melaka Manipal Medical College, Malaysia.
(3) Jaspinder Kaur, ECHS Polyclinic, India.
Complete Peer review History: http://www.sciencedomain.org/review-history/16252

Original Research Article

Received 7th July 2015
Accepted 25th September 2015
Published 20th September 2016

ABSTRACT

Aim: This anthropometric study assessed the morphological characteristics of male (n=65) and female (n=48) undergraduate medical students of the University of Lagos.
Methodology: Subjects were aged 18-29 years, with male mean age 23.6 ± 3.3 and female mean age of 22.7 ± 3.4. Stature, body mass, arm girth, calf girth, biepicondylar humerus breath, biepicondylar femur breath, triceps, subscapular, supraspinale and medial calf skinfolds were measured using standardized equipments and procedures to determine the somatotypes of subjects, according to the Heath-Carter anthropometric method. Data was analyzed for descriptive and inferential statistics. The probability level for rejection of null hypothesis was 0.05.
Results: Mean male endomorphy was 2.5 ± 1.0, mesomorphy 4.0 ± 1.7 and ectomorphy 2.8 ± 1.2. Female mean endomorphy was 4.6 ± 1.2, mesomorphy 3.9 ± 1.9 and ectomorphy 2.0 ± 1.2. Male somatotypes are clustered around mesomorphy with 24.6% endomorphic mesomorph, 23.1% balance mesomorph and 13.9% ectomorphic mesomorph. 25.0% of the females were mesomorphic endomorph, 20.8% mesomorph endomorph and 20.8% endomorphic mesomorph.

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Conclusion: The results also suggest that for non-obese apparently healthy youths, anthropometry provides a better estimate of body fatness than body mass index (BMI).

Keywords: Somatotype; endomorphy; mesomorphy; ectomorphy; anthropometry.

1. INTRODUCTION

Somatotyping is a method of describing the human physique in terms of a number of traits that relate to body shape composition [1]. The development of somatotyping was first proposed by Sheldon in 1940 and subsequently modified by others. It has proved to be a good descriptive and classification system for learning about relative shapes and variations in samples or populations [2,3,4]. It has been widely applied in the fields of medicine, sports, psychology and anthropology [5,6]. Body composition is examined from the perspective of mortality and morbidity in obesity, proportionate changes during growth, and functional relationships with fitness and sport performance, nutrition, cultural differences and many others [7]. It may be approached at any organisational level as the sum of the appropriate component parts. Knowledge of the interrelationship of constituents within a given level or between levels is important for a basic understanding of body composition, and may be useful for indirectly estimating the size of any given compartment [8].

Since direct validation of new methods is not practical, established relationship between tissues have been employed to make the best estimate of body composition [9,10]. The methods employed include; Densitometry which is based on the idea that the proportion of fat to non-fat can be calculated from the known densities of the two compartments and the measured whole-body density. Another method is the estimation of proportionate fatness from equation based on skinfold thickness. Assessment of fat-free mass by the method of bioelectrical impedance analysis (BIA) based on the electrical properties of hydrous and anhydrous tissues and their electrolyte content. BMI (body mass index) which uses a ratio that says something about body composition primarily on the basis of various epidemiological studies. A simple subdivision of fat deposits has been made by use of a ratio between waist circumference taken at the umbilicus and hip circumference taken at the maximum gluteal girth. Proportionate muscle mass estimated by using skinfold corrected diameters of muscle from the upper arm, forearm, thigh and calf multiplied by stature and an empirically derived constant. Proportionate bone mass estimated from an equation that included stature, the maximum diameter of the humerus, wrist, femur and ankle and a mathematical constant. The 'O Scale' developed by [7]. In this method, an individual is plotted on two parallel nine-point scales for adiposity, measured by the sum of skinfolds and body weight relative to normative data (>22000 Canadian subjects) for age and gender. The resulting graph provides separately, the individual status of body weight and adiposity relative to a normal population.

Physique is a composite, referring to an individual's body form i.e. the conformation of the entire body as opposed to emphasis on specific features. The study of human physique can be traced back to the earliest writing of man [11]. Later on, the development of anthropometry added a new dimension to the study of human morphology [11,4]. The new Heath-Carter somatotype method, created by Heath and Carter in 1967 and partly influenced by ideas from Parnell in 1954, is now the universally most applied, though two other original methods were introduced by Lindegard (1953) and by Conrad (1963). They are less used than the Heath-Carter, method, which uses a phenotypic approach proposed with open rating scales for three components, and ratings that can be estimated from objective anthropometric measurements [1].

A somatotype is a quantified expression or description of the present morphological conformation of a person. It consists of a three number- rating representing endomorphy, mesomorphy and ectomorphy components respectively. E.g. 3.5-5-1. The three numerals are always physique [12]. There are basically two ways of obtaining somatotype. The first is based on a visual inspection of the subject, or their photograph. This method is called the photoscopic (or anthroposcopic) somatotyping [13,14]. The other method of assessing somatotype is through anthropometric measurements. Somatotype is calculated from a set of 10 measurements: height, weight, four skin folds (triceps, subscapular, supraspinale and medial calf), two biepondylar breaths (humerus

and femur) and two girths (upper arm flexed and tensed, and calf). The recommended somatotyping procedure is a combination of an anthropometric followed by a photoscopic evaluation [1,4]. Endomorphy is the first component of a somtotype. It describes the relative degree of fatness of the body, regardless of where or how it is distributed. The second component, called mesomorphy, describes the relative musculoskeletal development of the body. Ectomorphy, the third component, describes the relative slenderness of the body. It also describes corresponding physical aspects such as the relative 'stetchedoutness'.

Sheldon et al. [11] identified nineteen categories of somatotype, which were later reduced to thirteen by Heath and Carter (1990) [14]. They are as follows; Central type, Balanced endomorph, Mesomorphic Endomorph, Mesomorph-Endomorph, Endomorphic Mesomorph, Balanced Mesomorph, Ectomorphic Mesomorph, Mesomorph-Ectomorph, Mesomorphic Ectomorph, Balanced Ectomorph, Endomorphic Ectomorph, Endomorph-Ectomorph and Ectomorphic Endomorph [1].

The somatotype tells what kind of physique one has and how it looks. It has been used to describe and compare the physique of athletes at all levels of competition and in a variety of sports [15,16,17]. Somatotyping has also been used to describe physique changes during growth [18,19,20], diseas [21,22,23], ageing [1] and training [24], as well as in relation to nutrition [25, 26] and physical performance [27,28]. The use of somatotyping as an adjustive chiropractic tool [29] and in human behavioural or temperamental studies (Kretsc, have also been documented. The morphological profile, as assessed through anthropometric somatotyping, of Nigerian athletes [5], adolescents [6] and students studying physical education [2,30] have been described. Also described is the somatotype of male medical students in Bulgaria [31]. However, no published work was found in which this kind of study has been conducted among medical students in Nigerian Universities. The aim of this study therefore, is to determine the somatotypes of medical students at the College of Medicine, University of Lagos.

2. MATERIALS AND METHODS

A total of 113 subjects, comprising male (65) and female (48) volunteers with ages ranging from 18 to 29 participated in this cross-sectional study. The study, which lasted for a period of three months, was conducted in the Department of Anatomy of the University of Lagos, Nigeria. Ethical approval was obtained from the Institution's research ethics committee. Subjects were randomly drawn from among 200-600 level undergraduate medical students of the College of Medicine, University of Lagos. Subjects who are 30 years and above or those with physical deformity were excluded from the study. Prospective study subjects were informed of the purpose, risks, and benefits of the study, and those who volunteered to participate gave their written consent before the study. The following variables were assessed: age, height, weight, biepicondylar humerus breath, biepicondylar femur breath, arm flexed and tensed girth, standing calf girth, triceps skinfold, subscapular skinfold, supraspinale skinfold and medial calf skinfold. Measurements were done with the use of standard equipments and procedures, as described by Carter and Heath (1990) and recorded. Measurements were done by one skilled researcher in order to eliminate inter-observer error.

Computation and statistical analysis was done on computer with Excel 2003 for Microsoft windows and somatocharts plotted with CorelDraw version 12. Data were analysed for descriptive and inferential statistics of age, weight, height, skinfolds, girths and breaths. BMI, HWR, endomorphy, mesomophy, ectomorphy, X-component and Y-component, Somatotype group means and Somatotype Attitudinal Means (SAMs) were also determined. The frequencies, percentage frequencies and chi-square test for comparison of proportion were evaluated for somatotype categories.

3. RESULTS AND DISCUSSION

Table 1 shows the sample distribution of undergraduate medical students of the University of Lagos. The number of males in the sample is 65, representing 57.5% of a sample size of 113 while the number of females is 48, representing 42.5% of the sample size. Sample drawn from 200L, 300L, 400L, 500L, and 600L classes constitutes 30.1%, 23.9%, 18.6%, 16.8% and 10.6% of the sample size respectively.

Table 2 is the descriptive statistics of the morphological variable of undergraduate medical student of the University of Lagos. There is no significant difference in age and calf girth for both male and female subjects. Body weight, height,

humerus breadth, femur breadth, and arm girth of male subjects are significantly higher than those of female subjects. Triceps skinfold, subscapular skinfold, supraspinale skinfold, medial calf skinfold and the sum of three skinfold are significantly higher in the females than the males.

Results presented in Table 3 shows there is no significant difference in BMI between male and female undergraduate medical students of the University of Lagos. This is despite significant differences in both height and weight for the two groups, as presented in Table 2. The mean somatoype of male medical student is 2.5 -4.6 -2.8 with SAM of 2.04 compared with 4.6 -3.9 -2.0 for the females with SAM of 2.20. The endomorphy component of females is higher than that of males. Both mesomorphy and ectomorphy are significantly higher in males than females. It is observed here that the relative body fatness, as indicated through the endomorphy ratings of males and females is significantly different, although the body mass index (BMI) of both groups does not differ significantly.

Table 4 shows the frequency and percentage frequency of somatotypes of undergraduate medical students of the University of Lagos. The proportions of females who are balanced endomorphs, mesomorphic endomorph, mesomorph endomorph and ectomorphic endomorph are significantly higher than the males while the proportions of males who are balanced mesomorphs, ectomorphic mesomorph and mesomorphic ectomorph are significantly higher than the females. Other somatotype categories exhibit similar distribution pattern among the two groups, and none of the subjects is a balanced ectomorph. The chart in Fig. 1 further illustrates the somatotype distribution, indicating that undergraduate male medical students of the University of Lagos show a fairly consistent pattern of dominant mesomorphy and moderately high ectomorphy with 24.6% endomorphic mesomorphs, 23.1% balanced mesomorphs and 13.9% ectomorphic mesomorphs.

Table 1. Sample size distribution of undergraduate medical students of the University of Lagos

Class	Males	Females	Males and females
200L	19	15	34
300L	15	12	27
400L	12	9	21
500L	11	8	19
600L	8	4	12
Total	65	48	113

Table 2. Descriptive statistics of morphological variable of undergraduate medical students of the University of Lagos

Variable	Male=65			Female=48			T value
	Mean	S.D	Range	Mean	S.D	Range	(p<0.05)
Age (years)	23.6	3.3	18-29	22.7	3.4	18-29	1.408
Weight (kg)	66.1	7.7	54-84	61.5	9.8	45-91	2.695
Height (cm)	172.7	7.3	156.0-188.3	163.0	6.6	150.1-176.8	7.380
Triceps skf (mm)	8.2	3.9	3.0-19.0	17.7	5.9	9.5-34.0	9.700
Subscapular skf (mm)	10.0	3.9	4.0-25.0	15.0	5.1	8.0-32.5	5.676
Supraspinale skf (mm)	7.7	2.8	3.0-15.5	14.2	4.9	4.0-27.0	8.250
Sum of 3 skfs (Trp, Supra & subs)	25.8	3.9	11.0-59.0	46.9	14.2	25.0-88.5	8.925
Calf skf (mm)	9.7	4.0	3.0-23.5	20.8	7.2	10.5-37.0	9.639
Humerus breadth (cm)	6.41	0.77	4.75-8.00	5.79	0.59	4.35-7.15	4.845
Femur breadth (cm)	9.38	0.83	7.65-11.55	8.59	1.08	6.55-12.60	4.229
Arm girth (cm)	32.0	3.8	26.5-48.6	29.5	83.2	21.3-39.9	3.738
Calf girth (cm)	36.2	9.5	31.1-50.0	35.6	3.4	28.5-46.8	0.882

Table 3. Body indices, somatotypes and comparative t-test of undergraduate medical students of the University of Lagos

Parameter	Males (n=65)	Females (n=48)	t-value (p<0.05)
Age (yrs)	23.6±3.3	22.7±3.4	1.408
BMI	22.2±2.3	23.2±3.8	1.618
HWR	42.8±2.8	41.5±2.2	2.763
Endomorphy	2.5±1.0	4.6±2.2	9.857
Mesomorphy	4.6±1.7	3.9±1.9	2.024
Ectomorphy	2.8±1.2	2.0±1.2	3.503
X-component	0.2±1.5	-2.6±2.0	8.153
Y-component	3.8±4.0	1.2±4.0	3.415

Table 4. Frequency and percentage frequency of somatotype category of undergraduate medical students of the University of Lagos

Category	Males (n=65)		Females (n=48)		X^2 value (P<0.05)
	F	% F	F	% F	
Balanced endomorph	1	1.5%	4	8.3%	3.92
Mesomorphic endomorph	1	1.5%	12	25%	14.70
Mesomorph endomorph	3	4.6%	10	20.8%	7.21
Endomorphic mesomorph	16	24.6%	10	20.8%	0.22
Balanced mesomorph	15	23.1%	-	-	12.76
Ectomorphic mesomorph	9	13.9%	-	-	7.21
Mesomorph ectomorph	4	6.2%	1	2.1%	1.08
Mesomorphic ectomorph	7	10.8%	-	-	5.50
Balanced ectomorph	-	-	-	-	0.00
Endomorphic ectomorph	1	1.5%	2	4.2%	0.75
Endomorph ectomorph	2	3.1%	3	6.3%	0.67
Ectomorphic ectomorph	1	1.5%	4	8.3%	3.92
Central	5	7.7%	2	4.2%	0.59
Total	65	100%	48	100%	

Y=211- (1+111)

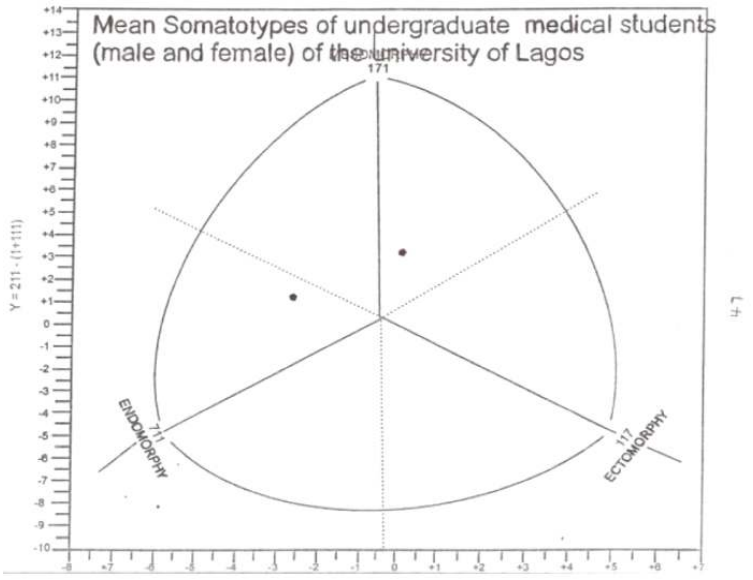

Fig. 1. Somatochart showing male and female undergraduate medical students of the University of Lagos

Considering the difference in morphological variables of male and female undergraduate medical students of the University of Lagos, it can be concluded that undergraduate male medical students of the University of Lagos, are taller and heavier than their female counterparts. They also have larger bones than the females. Female undergraduate medical students on the other hand have more relative fat than their male counterparts. Since there is no significant difference in age between the two groups, it is presumed that morphological variations exhibited may be due to some measure of genetic factors, dietary patterns, physical activities, hormonal and other socio-cultural or environmental factors. Crist and Hill (1990) showed that the differences in body composition may be influenced by endogenous peptide anabolic hormone secretion and diet. In the work of Bronks and Parker (1985), it was observed that body fat did not increase with age in adults with Down syndrome but was consistently high at all age levels, suggesting that elevation of body fat levels occurred in prior to adulthood. Male medical students of the University of Lagos are generally balanced mesomorphs while the females are mesomorphic endomorphs. This compares with somatotype of university students studied by other researchers elsewhere, which showed that male physical education students showed a fairly consistent pattern of dominant and moderately high mesomorphy, while female physical education students clustered around mesomorphic endomorphy [32,33,34,35,36,37]. The pattern of somatotype distribution among undergraduate male medical students of the University of Lagos can also be compared with those from Bulgaria. Radev et al., (1985) had reported a similar pattern of somatotype distribution among male medical students in Bulgaria with 55.9% having a predominance of mesomorphy. Undergraduate female medical students of the University of Lagos show dominance in endomorphy with majority clustered around mesomorphic endomorph (25%), mesomorph endomorph (20.8) and endomorphic mesomorph (20.8%). The present study indicates that Body Mass Index (BMI) may not effectively or accurately assess body fatness. The significant difference between male and female endomorphy, which is related to adiposity [38], is not reflected in their Body Mass Index.

4. CONCLUSION

Undergraduate male medical students of the University of Lagos have higher mesomorphy and ectomorphy components than their female counterparts. The females are in turn more endomorphic than males. Comparing the findings from this work with the somatotype of male medical students in the University of Lagos is similar to those in Bulgaria. Though it remains to be determined if our findings on the females compares with female medical students from other parts of the world. These results also suggest that for non-obese apparently healthy youths, anthropometry provides a better estimate of body fatness than body mass index (BMI).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/16252